Investigating Infant catching using the TASC-based approach

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SPEAKERS/ LECTURERS/ SYMPOSIA

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KEYNOTE SPEAKERS

Predictors and Consequences of Sport Participation

Eccles, J. University of Michigan

I will summarize my Expectancy-Value Model of Achievement-Related Choice as it is applicable to sport participation, and will present recent findings on the power of this model to predict sport involvement. Across three longitudinal studies, we have found that children's and adolescents' sport ability self-concepts, and the importance as well as the intrinsic and utility value they attach to sport, are strong predictors of starting in a sport as a child and continuing in that sport or another one during adolescence and young adulthood. These self- and task-related beliefs are also very strong predictors of time spent in sport and participation in high school and college competitive team sports. Finally, gender differences in these self- and task-related beliefs explain most of the gender differences in sport participation. These self- and task-related beliefs are even stronger predictors of these sport outcomes than are the equivalent beliefs in academic subject areas. Next I will discuss the role of parents in shaping these early beliefs and getting their children involved in sport activities during the elementary school years. Finally, I will summarize the research I and my colleagues have done to look at the association of participating in sports on other aspects of development and on developing a sport identity. Participating in high school team sports is related to wide range of positive educational and occupational outcomes, particularly for girls. It is also linked to higher than expected rates of alcohol consumption during the high school years. I will briefly discuss the possible causes of these associations.

How Do We Get About by Vision?

Patla, A.E. University of Waterloo

Vision is the only modality that can provide accurate and precise advance information about animate and inanimate features of the environment. It is not surprising that most animals rely on vision to guide locomotion. Gibson in 1938 stated that "locomotion is guided chiefly by vision." In this talk I will focus on work done in our lab on visual guidance of adaptive human locomotion that tells us what the relevant visual information is and how it is used to guide action. Studies discussed will include monitoring of gaze behaviors during locomotion, effects of manipulation of visual information on gait patterns, matching of actual travel path data with those predicted by models that incorporate what type of visual information, and when and how this visual information is used for path navigation (including obstacle avoidance and foothold selection) through a cluttered terrain.

The Perception of Locomotion and the Early Development of Dynamic Spatial Orientation

Rieser, J.J. Vanderbilt University

Locomotion is both a class of actions and a class of perceptible events. As a class of actions, it is embedded in its environmental context and participates in fight, flight, and many functional behaviors. As a class of perceptible events, it is central to dynamic spatial orientation, that is, keeping up with the changes in self-to-object distances and directions that occur during locomotion. People perceive their locomotion and spatial orientation rela-

tive to the environment as a frame of reference. When walking with vision, the problem is to understand how vision and action are coordinated so that people produce motoric distances and directions of action that fit with perceptually specified distances and directions toward goal. When walking without vision, locomotion is similarly coordinated with the remembered surroundings and reflects the coordination of action with representation. This talk is focused on locomotion and on spatial orientation when people walk without vision and without access to nonvisual information about their surroundings. The thesis is that when walking without vision, people perceive their locomotion relative to the represented environment as a frame of reference. The resulting dynamic representation is used to steer ongoing locomotion and control other environmentally directed actions. Such dynamic spatial representations come on-line early in life. Learning must serve to fine-tune the integration of locomotion with varying environmental conditions and with physical growth. Visual experience facilitates the integration. This talk will emphasize three lines of empirical research. One line is aimed at understanding learning processes through which the biomechanical activities of locomotion are calibrated in terms of the surrounding environment. A second line is aimed at validating psychophysical methods to assess the precision and systematic error in the spatial orientation of children 2–10 years of age. And a third line of research is aimed at understanding how motor experience and visual experience tend to work together to facilitate development.

SENIOR LECTURERS

Growing Our Science Through Mixed-Methods Research

Scanlan, T.K. University of California, Los Angeles

When I learned that the Senior Lecturer session was going to be attended by all areas of NASPSPA, I decided to make my presentation more inclusive of the broad interests of the Society and not focus exclusively on sport psychology. Hence I will address the issue of using a mixed-methods approach across our research specialties. Mixed-methods is a logical extension of the multi-method approach for quantitative studies espoused in the past, and involves the effective and efficient incorporation of quantitative and qualitative methods into one's line of research. The types of qualitative methods are many and varied (e.g., interviews, focus groups, behavioral observations, and ethnographies), with each serving different purposes (see Patton, 2002, for elaboration). After a general discussion of mixed-methods, I will present an overview of the Scanlan Collaborative Interview Method (SCIM) which is a new approach using in-depth interview data for theory development, testing, and expansion purposes (Scanlan, Russell, Wilson, & Scanlan, 2003; Scanlan Russell, Beals, & Scanlan, 2003). While I will use our research on the Sport Commitment Model to demonstrate SCIM, the method applies to theory construction in any area of research.

Lines of Research: Theory Leading to Intervention

Ulrich, B.D. University of Michigan

In this talk I will focus on my research involving two populations that have fundamentally different constraints from persons with typical development (TD), that is, Down syndrome (DS) and spina bifida (SB). My goals will be to (a) draw parallels between the rationale for the sequence of questions we planned and conducted, including basic and clinical, in each set of studies, and (b) highlight our data emerging over the past year from our work involving infants with SB. In the studies we conducted that involve persons with DS, the issue of basic vs. clinical discovery became interwoven over time; sometimes one

appeared to surface, and then the other. I believe this is an efficient approach, adding ecological validity to our efforts to refine our theoretical perspective and grounding our interpretation of clinical results in a broader, process-oriented context. Our studies of infants with SB were initially dedicated to building a database that could allow a closer examination of the debate over CPG vs. self-organized populations of spinal motor neurons. Preliminary results from our longitudinal study, along with very recent data emerging from the animal literature focused on spinal cord lesions, have given rise to new and exciting hypotheses related to possible clinical interventions for this population. I will discuss our goal of investigating further the potential for impacting the integrity and development of the nervous system of infants with SB through supported treadmill stepping.

Timing With and Without a Representation of Time

Zelaznik, H. Purdue University

Classical models of timing posit a central representational component. The individual uses this representation to time the occurrence of events. Alternatively, it is also plausible to assume that timing is an indirect consequence of the control of a movement trajectory that does not have time in its primary description; in other words, borrowing from Turvey, timing is emergent. In this talk I will review the last 5 years of work from our laboratory which we believe supports this bivariate description of timing processes. We will describe behavioral and neuropsychological experiments that we believe supports an event timing/ emergent timing distinction.

SYMPOSIA

Sport Psychology

"Peer-Assisted Learning (PAL) in Physical Activity Contexts: Theory, Research, and Applications Relevant to Sport Psychology and Motor Behavior"

Weiss, M.R[1], F. Arripe-Longueville[2], P. McCullagh[3] and C. Stuntz[1]. [1]University of Virginia; [2]Université de Nice Sophia-Antipolis; [3]California State University–Hayward

Peer-assisted learning (PAL) refers to a set of theory-based, peer-led strategies that impact knowledge, skills, and attitudes in a variety of domains and social contexts (Cowie, 1999; Topping & Ehly, 1998). Peers, who are similar in development or other characteristics (gender, ability, interests), have the potential to positively influence each other through such methods as peer modeling, peer tutoring, peer social support, peer education, and peer counseling. These methods have been empirically tested in educational, social, and developmental psychology studies (Schunk, 1998; Topping & Ehly, 1998), but little research has been conducted in the physical domain. This is surprising because PAL interventions are clearly salient to issues such as motor skill learning, peer relationships, physical activity behaviors, and psychosocial outcomes (motivation, self-esteem, moral development). The purpose of this symposium is to overview theory, empirical research, and practical implications related to PAL strategies in educational contexts, with specific emphasis on its suitability for sport psychology and motor behavior research and practice. Effects of peer tutoring and peer modeling on motor skill acquisition and psychological responses are highlighted, and future research directions are offered to encourage PAL interventions in sport, exercise, and motor skill settings.

Peer-Assisted Learning: Conceptual Basis and Educational Benefits

Weiss, M.R. University of Virginia

Peer-assisted learning (PAL) entails peers teaching, helping, and supporting one another's efforts in one-on-one or small group situations (Topping & Ehly, 1998). Peers helping peers is a topic with rich theoretical underpinnings. Piaget's (1932) cognitive developmental perspective was premised on the concept of "equilibration"—that conflict and resolution among equals results in cognitive, social, and moral growth, by offering opportunities to solve problems, be exposed to alternative viewpoints, and cooperate to achieve mutual goals. Vygotsky's (1978) social interactionist perspective suggests that asymmetrical reciprocal relationships result in maximal learning within observers' "zone of proximal development" (level of task difficulty is matched to ability potential). Rogoff (1990) extended these ideas to "apprenticeship in thinking" whereby translation of knowledge and skills from "master" to "apprentice" is accomplished through collaborative learning activities. Two PAL strategies—peer tutoring and peer modeling—are strongly supported in the psychology literature. Numerous cognitive, social, and affective benefits are shown for helpers, helped, or both, including improvements in active and participative learning, social relationships, self-confidence, commitment, empathy for others, and self-regulated behaviors. Because peer tutoring and peer modeling offer cooperative learning strategies that have an impact on motor, psychological, and social outcomes, PAL offers a theoretically-grounded, empirically-supported set of strategies that translate well to physical activity and motor skill settings.

Peer Tutoring: Strategies for Enhancing Motor Skill Acquisition and Psychosocial Development

Arripe-Longueville, F. Université de Nice Sophia-Antipolis

Peer tutoring in school is a procedure in which children teach tasks to other children, usually on a one-on-one basis (Topping & Ehly, 1998). Research on peer tutoring is founded firmly in the theorizing of Vygotsky (1962, 1978), who saw asymmetrical social interactions as the key by which learning proceeds. While there is a rich base of knowledge on the cognitive, affective, and social benefits of peer tutoring in the educational and developmental literature, little is known about this topic in physical activity contexts. The purpose of this presentation is to illuminate some recent studies of peer tutoring in the physical activity domain: (a) characteristics of peer-tutoring (d'Arripe-Longueville et al., 2002a); (b) influence of characteristics of the tutor on the tutee's psychosocial responses and performance (d'Arripe-Longueville et al., 2002b); and (c) benefits of peer tutoring for tutors themselves (Legrain et al., 2003a, 2003b). Major findings of these studies indicate that: (a) peer tutoring spontaneously emerges in expert/novice dyads, especially among females; (b) the tutor/tutee competence gap and gender influence the tutee's self-efficacy and performance; and (c) trained peer tutoring entails the most favorable psychosocial and motor learning consequences for the tutors themselves. Practical applications for effective tutor/tutee pairings in sport and physical activity contexts will be discussed, and promising research directions will be outlined.

Peer Modeling: Strategies for Enhancing Motor Skill Acquisition and Psychosocial Development

McCullagh, P. California State University–Hayward

Peer modeling, because of perceived similarity between demonstrator and observer, is a powerful means of promoting behavioral and psychological change in learners (Schunk, 1987, 1998). The mechanisms explaining why peer modeling works are grounded in social-

cognitive theory (Bandura, 1986, 1997). Peer models impart *information* relevant to learning new skills, correcting errors, and adopting alternative strategies and self-regulation skills. Peer models also *motivate* observers by enhancing attention, self-efficacy, and the desire to master skills. Peer models may also be helpful with observers who lack confidence or who experience anxiety with particular tasks (e.g., water activities, fear of being hit by a baseball). Several modeling studies conducted in the physical activity domain demonstrate benefits of peer modeling for learning and performing skills, as well as for enhancing self-efficacy and motivation (e.g., Feltz, 1980; McCullagh et al., 1990; Weiss et al., 1998; see McCullagh & Weiss, 2001, 2002). The purpose of this presentation is to examine the empirical literature on the influence of peer models in the observational learning paradigm, and offer future research ideas and practical implications for sport/exercise psychology and motor learning settings.

Peer-Assisted Learning: Future Research and Applied Directions

Weiss, M.R., and C. Stuntz. University of Virginia

Research in motor behavior and sport psychology has shown promise for peer-assisted learning (PAL) methods, particularly peer tutoring and peer modeling, as effective ways of teaching motor skills and enhancing positive psychosocial outcomes (self-efficacy, motivation). Given its emphasis on collaborative learning, PAL offers a conceptually sound, empirically supported set of strategies to maximize outcomes in physical activity contexts. PAL may accomplish this by complementing direct teaching by adults, providing insights in a more comprehensible way, and fostering cooperative goals and teamwork to ensure individual and group success. Relevant areas of future research using PAL interventions include: (a) development of expertise; (b) enhancing physical activity behaviors in at-risk populations; (c) developing peer leadership skills in sport and exercise; and (d) enhancing positive peer relationships such as peer acceptance and reciprocated friendships. Theory- and research-based practical applications of PAL are customized for motor skill, sport, and exercise settings.

Motor Development

"Modeling Strategies for Utilizing Dynamic Resources Over Developmental Time"

Ulrich, B.D. University of Michigan

In this symposium we will present data that describe the kinematics and kinetic patterns of behavior demonstrated by persons with typical development (TD) and with Down syndrome (DS). The focus is on change in their patterns at two points in developmental time, from the point when they began walking to the preadolescent period, after they have had several years of relatively uniform growth and years of practicing this functional task. To probe the underlying strategies used by these groups to generate the observed movement patterns, we have been utilizing the tools of mathematical modeling. Specifically, we have applied an inverted pendulum and spring with an escapement function model to compare the global stiffness and forcing generated by each group as they walk. Our results revealed that toddlers and preadolescents with DS exhibited kinetic and kinematic patterns that are somewhat counterintuitive, given their inherent constraints, specifically low tone. Their movement patterns are distinctly different from those of their TD counterparts. Further, the behaviors of both groups change over time in ways we believe would not have been uncovered without the use of a modeling approach such as we attempted. Our goal is to provide an overview of the developmental differences in the patterns of behavior produced and to illustrate the developmental issues uncovered through the use of our model.

Gait Parameters and the Kinematics of Walking: Preadolescents and New Walkers, With TD and With DS

Buzzi, U., M. Kubo, C.L. Chang, B.D. Ulrich, and K.G. Holt*. University of Michigan; *Boston University

Our goal in this presentation is to contrast the kinematics of walking in children with DS and with TD, populations that can be argued to be under uniquely different physiological constraints. We also wish to compare their nascent performance with their performance after years of daily practice. In this paper we will outline the similarities and differences of 8 new walkers, able to walk only 3–6 steps (4 with DS and 4 with TD), and 24 preadolescents (12 with DS and 12 with TD). Anthropometric variables revealed some intriguing group differences; while preadolescents with DS had significantly smaller leg : trunk ratios than those with TD, at walking onset this difference did not exist. Height but not weight were significantly different for preadolescent groups, but for new walkers these parameters did not differ significantly. New walkers with DS walked faster than those with TD, while preadolescents with DS walked slower than those with TD. Step widths were wider across developmental levels for those with DS, while the step lengths of toddlers, but not preadolescents with DS, were longer than those of their counterparts with TD. Cycle durations were longer for TD groups at both points than for DS, though proportion of time spent in swing and stance did not differ at either point. Displacement time series showed that the necessary and sufficient flexion/extension reversals occurred in swing and stance, though details of timing and frequency of reversals, smoothness of trajectories, and amplitude of movement varied considerably for new walkers with DS and TD with no discernable group difference. By preadolescence most of this variability resolved, though the DS group continued to show significantly more variability around their mean trajectories We will discuss the complex way in which a variety of subsystems (e.g., anthropometrics, joint stability, experience) influence the emergent patterns we observe.

Kinetics of Walking: Dynamic Resource Use Changes Across Development and Between Children With and Without DS

Kubo, M.[1], U. Buzzi[1], K.G. Holt[2], E. Saltzman[2], and B.D. Ulrich[1]. [1]University of Michigan; [2]Boston University

We employed a mechanical model to probe the underlying dynamic resources (stiffness and forcing) used by two populations with intrinsically different constraints, persons with DS and with TD at walking onset and after 6–8 years of practice walking. We applied an inverted pendulum and spring with an escapement function model to compare the global stiffness and forcing impulse (from the initiation of plantar-flexion during stance to toe-off) generated by each group (4 toddlers with DS and 4 with TD; 12 preadolescents with DS and 12 with TD) as they walked overground at their preferred speed. Our results revealed that toddlers and preadolescents with DS exhibited resource use that was somewhat counter-intuitive, given their lack of tone, that is characteristic of these children. Resource use is distinctly different from their TD counterparts and the behaviors of both groups change over time. As new walkers, toddlers with DS generated significantly greater global stiffness than their TD counterparts ($p \leq .001$), although by preadolescence this difference disappeared. Across both points in time the participants with DS generated significantly higher forcing (impulse) values ($p \leq .014$, toddlers; $p \leq .001$, preadolescents). We suggest that the increased joint laxity which accompanies DS causes new walkers to use co-contraction to stiffen their bodies in order to maintain upright posture. Greater forcing impulse may be required to allow for locomotion due to this stiffer system, as well as inability to use storage and return of elastic energy in certain structures (e.g., the typically observed pes planus in children with DS). By preadolescence, persons with DS settle into a more efficient, less stiff

attractor pattern, similar to their TD peers. Continued higher impulse values as children with DS get older may reflect a continued or increased reduction in mechanical efficiency due to pes planus and higher amplitude of medial-lateral sway.

Modeling: Developmental Approach Uncovers Changes in Underlying Strategies

Holt, K.G.[1], E. Saltzman[1], C.L. Ho[1], M. Kubo[2], U. Buzzi[2], and B.D. Ulrich[2]. [1]Boston University; [2]University of Michigan

In the previous presentation we reported that in some cases beginning walkers demonstrate negative forcing impulses. Our work presented here was to test the notion that observed negative impulses at heel strike during walking are due to a timing issue in immature gait patterns. Using a hybrid pendulum and spring model of human gait to estimate impulses during the pushoff phase of gait, contrary to the finding in adults and preadolescents, some beginning walkers show negative impulses. It is proposed that in more mature gait, appropriately timed pushoff overcomes any negative impulses due to the following heel strike of the contralateral limb, and that the resultant impulse will be close to zero. It was hypothesized that for cases in which negative impulses are observed, there is greater time difference (Td) between heel strike of one foot and initiation of the immediately preceding ankle plantar-flexion (pushoff) of the contralateral limb. Our previously collected gait impulse data on new walkers (capable of 3–6 steps), and preadolescents (8–10 years) were assigned to positive and negative bins to serve as the independent variable. ANOVA was used to compare Td in the two conditions. As predicted, the time differences were significantly different ($p = .0042$) and in the predicted direction, that is, greater time differences were observed with negative impulses. Discussion revolves around the biomechanical and motor control implications for the development of mature gait and for an operational definition of skilled behavior within a Bernsteinian perspective.

Motor Learning

"Coordination Dynamics of Brain and Behavior"

Oullier, O. Florida Atlantic University

How does vision stabilize coordination between individuals? How do changes in the crossed modulation of excitability in homologous motor pathways promote increases of bimanual stability? How do sound and touch bind in sensorimotor coordination? How do muscular and directional constraints interact to determine the stability of interlimb coordination? All these questions were explored by the speakers of this symposium to better understand the role played by constraints of different nature in (de)stabilizing coordinative patterns. These enduring questions have enjoyed a recent resurgence as indicated by their extensive treatment in the literature on coordination dynamics. Two opposing claims—but I would argue not irreconcilable ones—emerge from this literature. First, behavioral stability is determined by the exclusive role of one dominant constraint that would elude the others. Second, the coalition of constraints determines stability context. In both cases, most of the studies have proceeded based largely on behavioral findings, unconstrained by neural evidence. Experimental studies will therefore be presented and discussed in light of recent findings in the neuroimaging field. The goal of the symposium is to show that coordination and brain dynamics studies complement each other in understanding the processes underlying coordinative stability.

Interactive Effects of Muscular and Directional Constraints on the Stability of Interlimb Coordination

Temprado, J-J., and R. Salesse. Université de la Méditerranée & CNRS

In recent years, most studies have been interested in determining how the cognitive (attention, intention), biomechanical, (neuro)muscular, and perceptive constraints may simutaneously influence spontaneous interlimb coordination dynamics. Though it is widely accepted that coordination dynamics result from a coalition of constraints, the interactive effects of the different constraints has been sparsely studied. In this symposium we will present a series of experiements carried out in our group to examine the interactive effects of muscular and directional constraints on the stability of preferred and learned interlimb coordination patterns. In these studies we used different coordination tasks (hand-foot coordination, bimanual coordination, between-people coordination) to explore the generality of directional constraints. We showed that relative direction of moving limbs (i.e., isodirectional or anisodirectional) influences the stability of coordination patterns independent of combination with muscular and egocentric constraints (Temprado et al., 2003; Temprado, Salesse, & Semjen, submitted). Moreover, the strength of the effect of relative direction of moving limbs on pattern stability proved to be dependent on the type of coordination performed. We also showed that directional constraint has perceptual basis, and specifically visual basis (Temprado & Laurent, 2003; Temprado, Saless, & Semjen, submitted). Moreover, the results of a learning study suggest the presence of directional abstract codes that influence the learning and transfer of new coordination patterns in combination with muscular constraints (Temprado & Swinnen, submitted). Other works are in process in our group to better understand the perceptual (visual and proprioceptive) basis of directional constraints in interlimb coordination. Preliminary results will be presented.

Spontaneous Interpersonal Synchronization is Modulated by the Degree of Visual Coupling

Oullier, O., G.C. de Guzman, K.J. Jantzen, J.F. Lagarde, and J.A.S. Kelso. Florida Atlantic University

Previous research has examined interpersonal coordination for when participants intentionally synchronized to the movements of another (Oullier et al., 2003; Schmidt et al., 1990; Temprado et al., 2003). Because the latter could certainly perform the role of a pacing stimulus (Kelso et al., 1990), it was not clear whether spontaneous mutual entrainment also occurred. In this study the participants sat facing each other, grasping horizontal dowels with the right hand in the pronate position. They had to execute self-paced rhythmic flexion/extension movements of the finger. Each trial was divided into 3 contiguous periods of 20 sec each, during which visual coupling between participants was controlled by instructing a priori each one to either keep his/her eyes open or closed without interrupting the ongoing movement. The interaction was therefore controlled by limiting visual contact between participants, the coupling being mediated by the exchange of visual information. Results show that when at least one participant performed with eyes open, movements of the two participants became spontaneously entrained despite the absence of any explicit instruction concerning intersubject coordination. The entrained movements were predominantly in-phase. When visual coupling was removed (both participants closed their eyes), the entrainment was lost. We report that humans involved in oscillatory behavior exhibit a spontaneous synchronization phenomenon when communication with neighbors is allowed, even if they are not given any instruction to do so. These results indicate that visual coupling provides a powerful constraint on the ability of two individuals to produce both independent and coordinated behavior.

Augmented Feedback Alters the Variations in Corticospinal Excitability Which Arise From Rhythmic Movements of the Opposite Limb

Carson, R.G., T.N. Welsh, and M-A. Pamblanco-Valero. University of Queensland

Augmented visual feedback can have a profound bearing on the stability of bimanual coordination. Indeed, this has been used to render tractable the study of patterns of coordination that cannot otherwise be produced in a stable fashion. In previous studies (Carson et al., 1999) we have shown that rhythmic movements, brought about by the contraction of muscles on one side of the body, lead to phase-locked changes in the excitability of homologous motor pathways of the opposite limb. The present study was conducted to assess whether these changes are mediated by the presence of visual feedback of the moving limb. Eight participants performed rhythmic flexion/extension movements of the left wrist to the beat of a metronome (1.5 Hz). In 50% of trials, visual feedback of wrist displacement was provided in relation to a target amplitude—defined by the mean movement amplitude generated during the immediately preceding no-feedback trial. Motor potentials (MEP) were evoked in the quiescent muscles of the right limb by magnetic stimulation of the left motor cortex. Consistent with our previous observations, MEP amplitudes were modulated during the movement cycle of the opposite limb. However, the extent of this modulation was smaller in the presence of visual feedback of the moving limb (FCR f = 0.70; ECR f = 0.77) than in trials in which there was no visual feedback (FCR f = 0.63; ECR f = 0.64). During phases in which the wrist moved from extension to flexion, MEPs evoked in the opposite FCR were larger in the visual feedback trials than in the no-feedback trials. The results of the present study support the view that increases in the stability of bimanual coordination brought about by augmented feedback may be mediated by changes in the crossed modulation of excitability in homologous motor pathways.

Multimodal Coordination Dynamics: The Binding of Movement, Sound, and Touch

Lagarde, J.F., and J.A.S. Kelso. Florida Atlantic University

The present study examined the stability and change of multimodal integration under parametric variation. Emphasis was placed on the coordination of movement with auditory and tactile stimuli that are not coincident. Vibrotactile rhythmic stimuli were applied to the tip of the right thumb via a custom stimulator (train of 80-ms wave pulses, 300 Hz, magnitude 2 volts). Auditory rhythmic stimuli (train of 80-ms wave pulses, pitch 500 Hz, magnitude 2 volts) were delivered via headphones. Movement was restricted to the metacarpophalangeal joint. Tactile and auditory control conditions required particiapnts to synchronize flexion or extension of the right index finger with each modality presented either alone or simultaneously. In the key experimental condition, haptic and auditory stimuli were presented antiphase with each other. That is, participants were instructed to flex on touch and extend on sound or vice-versa. They performed 3 trials in each condition. The frequency of rhythmic stimuli was increased from 1.0 to 3.5 Hz in steps of .25 Hz every 12 cycles. The relative phase between finger motion and metronome stimuli was computed, and an interactive inspection of the time series allowed us to examine percentage of transition between flexion and extension. In the key condition the crossmodal binding, regardless of the action (flexion or extension), is maintained over a range of frequency. At higher stimulus frequencies, destabilization occurs leading to switching between crossmodal patterns and to phase wrapping. More remarkably, extending to sound and flexing to touch switched to flexion on sound and extension on touch in 71% of the trials, while extending to touch and flexing to sound switched to flexion on touch and extension on sound in only 28% of the trials. This phase transition brings to light the multistability of the multimodal integration, and emphasizes the determining role of both action and modality.

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Brain Areas Related to Instabilities in Sensorimotor Coordination as Revealed by Functional Magnetic Resonance Imaging

Jantzen, K.J., O. Oullier, F.L. Steinberg, and J.A.S. Kelso. Florida Atlantic University

Unimanual, sensorimotor coordination, when performed at low movement rates, is bi-stable, displaying a tendency toward either synchronization (moving with an external stimulus) or syncopation (moving directly between stimuli). Under parametric increases in movement rate, the syncopated patterns become unstable until at some critical frequency the system passes into a mono-stable regime and spontaneous switches to the synchronized coordination pattern ensue. Functional imaging studies have demonstrated robust differences in neural activity underlying these two coordination patterns when performed at movement rates well within the bi-stable regime. When compared to synchronization, syncopation is associated with increased activity in a broad network of cortical and subcortical regions including SMA, premotor cortex, cerebellum, and basal ganglia. Such data suggest that neural networks distinguishing between coordination modes may be related to the relative differences in stability and contribute to the generation of large-scale behavioral transitions observed behaviorally. Here we use blood oxygen level dependent (BOLD) functional magnetic resonance imaging (fMRI) to measure neural activity of the whole brain in order to establish a relationship between brain areas that distinguish between the two stable coordination patterns and behavioral instabilities revealed by increases in cycling frequency. Sixteen participants pseudoramdomly performed synchronization and syncopated in the magnet at five frequencies ranging from 0.75 to 1.75 Hz in 0.25-Hz increments. We hypothesized that if activity within specific neural areas is related to the degree of behavioral stability, BOLD signal amplitude should increase with increasing movement rate only during syncopation and not during synchronization. Results support this hypothesis and, when taken together with previous research, provide important insight into the central neural mechanisms of dynamical behavioral phenomena.

Motor Development

"Contemporary Perspectives on Learning, Maturation, and Development"

Anderson, D.I. San Francisco State University

Historically, the terms learning, maturation, and development have referred to distinct processes underlying changes in motor behavior. The distinction was reified over time by competing theories of behavioral change that were largely one-dimensional, stressing either internal (maturation) or external (learning) factors as the primary determinants of that change. It is plausible that the term development retained its independence from learning and maturation simply because it offered the possibility that changes in behavior were a function of both internal and external factors. Indeed, contemporary perspectives on motor development now acknowledge—actually stress—that all behavior emerges from a complex blend of processes that occur at multiple levels of the organism/environment system. However, such perspectives have led to a blurring of the distinctions among the terms learning, maturation, and development. The terms are now often used synonymously and there seems no clear consensus as to whether they refer to the same or different processes. Some researchers have even suggested that the terms no longer serve a useful function, and they have recommended that the terms be either redefined or abandoned, with a concurrent shift in developmental research strategy toward an examination of the myriad constraints from which behavioral change emerges. Others have claimed the opposite, arguing that much can be learned about the process of change by preserving the distinctions among terms. So,

where do we stand? The purpose of this symposium is to explore that question with four presentations which offer a mix of perspectives on the issues mentioned above. In addition, the symposium will highlight the empirical strategies that have been used recently to tease apart the various contributions to behavioral change.

Learning, Development, and the Delineation of Change: Past, Present, and Future Considerations

Witherington, D.C. University of New Mexico

Traditionally, learning and development have been distinguished in terms of source for change. Forces external to the organism shape its very nature in classic learning accounts, whereas maturational, genetic forces assume privileged status in the unfolding of developmental change. The modern systems' emphasis on process and relationship has rendered such exogenous/endogenous distinctions untenable; the source of new forms across time resides in the relationship among multiple components situated across organisms and their environments, irreducible to any single component. Some remnants of the classic divide survive. Gibsonians, though focused on relationship as the fundamental source of form, argue that information resides in the already structured environment, available for "discovery" or "pick-up." It is no coincidence that Gibsonians preferentially employ the term "learning" to describe such processes of information pick-up. However, in light of the field's transactional emphasis on organism-environment relationships, learning and development have increasingly been used interchangeably, especially given the penchant of many current dynamic systems approaches for regarding developmental-time and real-time change as one and the same. Such synonymous use masks a number of important distinctions critical to discussions of process, e.g., the extent to which change is reversible or irreversible, the extent to which change takes place locally, in terms of highly context-specific adaptations, or more globally, in terms of system-wide reorganization. These are some of the dimensions of change that, though thoroughly interdependent and continuous, mark distinct and unique aspects of process. The distinction between learning and development can be usefully applied in this regard.

The Development and Learning of Inhibition in Infancy

Berger, S.E. Adelphi University

In a series of novel, age-matched, locomotor A-not-B tasks, modeled after Piaget's (1954) classic manual search task, infants had to inhibit making their way over to a previous location of a goal to successfully reach it at a new location. Increasing cognitive load by manipulating task difficulty elicited perseveration—the inability to inhibit a compelling behavior—in 13-month-old infants who do not normally perseverate in the manual search version. When infants had to make their way over to a goal that had previously been at a different location, perseverative responses varied according to task difficulty in three ways. First, walking infants were more likely to perseverate than crawlers. Second, the greater the motor effort required to perform a task (descend stairs, take a detour path, crawl through a tunnel), the more infants who perseverated. Third, within tasks, walking experience predicted the extent of infants' ability to inhibit. For example, less experienced walkers perseverated dramatically—going to the old location before making a detour to reach the goal—whereas more experienced walkers perseverated subtly—merely looking over to the old location or hesitating before going to the new location. Examining the interaction between disparate developmental domains—cognition and locomotion—delineated development and learning in skill acquisition. Although 13-month-old expert crawlers "learned" to inhibit when the cognitive load was alleviated, novice walkers had to relearn inhibition before they mastered walking. Thus, the emergence of newly developed skills can provide opportunities for learning, and learning may be context-specific.

Development and Learning: A Useful Distinction With a Common Approach

Whitall, J. University of Maryland, Baltimore

Depending on one's theoretical perspective, one can argue that development and learning are synonymous terms varying only perhaps in timescale, or dichotomous terms varying in fundamental ways that imply different underlying processes at work studied at different times through the lifespan. In this presentation I will suggest an alternative to these classic, polar viewpoints. If motor development is defined as "the changes in motor behavior over the lifespan and the processes which underlie these changes" (Clark & Whitall, 1989, p. 194), then learning may be conceived of as one process that underlies these changes across the lifespan. Thus development includes learning, and learning is a part of development. However, the reverse argument does not hold. Put another way, all learning is development but not all development is learning. In addition, from my perspective it is time that the approach to studying either concept should contain the same tools and constructs. The consequences of this distinction and common approach will be elaborated upon and explored with reference to empirical work on children with and without Developmental Coordination Disorder (DCD).

Investigating Infant Catching Using the TASC-Based Approach

Savelsbergh, G.J.P., K.S. Rosengren*, and J. Van der Kamp. Vrije University Amsterdam; *University of Illinois

A theoretical approach, the TASC-based approach is presented as an alternative account for examining change over time both with respect to development and learning (Rosengren, Savelsbergh, & Van der Kamp, 2003). The TASC label stands for a focus on particular tasks, and adaptation and selection of behaviors as a function of constraints. This account is grounded in evolutionary theory and assumes that variability, selection, and adaptation are central to change over time within individuals. Emphasis is placed on the tasks that individuals attempt to solve in achieving particular goals, given the constraints of the local environment and the organism. The approach will be illustrated with empirical data of an infant "catching" experiment (Van Hof, Van der Kamp, & Savelsbergh). This experiment examined the link between visual perception and adaptive control of action. Infants were required to intercept a toy approaching at different velocities ranging from 0.10 to 2.0 m/s. It was found that infants anticipate the arrival of the ball and used different strategies (e.g., a time and/or distance strategy) to initiate their interception movements.

Sport Psychology

"New Methodologies in the Psychology of Sport and Physical Activity"

A.M. Williams[1], N.J. Hodges[1], R.R. Horn[2], C.M. Janelle[3], and G. Tenenbaum[4]. [1]Liverpool John Moores University; [2]Montclair State University; [3]University of Florida; [4]Florida State University

Those interested in the psychology of sport and physical activity have typically relied on paradigms borrowed from the parent discipline, particularly cognitive psychology. Although these methodologies have been fairly successful in outlining some of the important mechanisms underlying effective performance and learning, there has been widespread criticism in relation to their perceived lack of ecological validity and associated difficulties with measurement sensitivity. There has been an overemphasis on simplistic or contrived laboratory tasks and on outcome rather than process measures of performance and learning. In recent years psychologists with an interest in sport and physical activity have developed

new and innovative approaches that better reflect the demands on individuals during performance and learning. Such developments are important indicators in regard to the growing maturity of the field. These approaches have enhanced measurement sensitivity and helped to better identify the subtle mechanisms that differentiate skilled from less skilled performers, in both laboratory and real-world settings. The aim of this symposium is to review recent developments in four prominent areas of research interest within the field, namely emotion and performance, perceptual expertise, motor learning and instruction, and statistical analysis.

Identifying Critical Information for Learning Through Demonstration and Instruction

Horn, R.R.*, N.J. Hodges, S.J. Hayes, and A.M. Williams. *Montclair State University; Liverpool John Moores University

An understanding of the critical sources of information that guide the reproduction of movement form, movement dynamics, and task outcomes is essential for facilitating learning. Armed with this information, instructors may guide learners' attention to pertinent information in demonstrations, or may remove redundant information to simplify the task. However, only recently have researchers systematically investigated the nature of information picked up during demonstrations along with kinematic measures of performance. Such methods have included visual search assessments and comparisons of learning from full body, relative motion, and isolated absolute motion sources. Furthermore, analyses of a model's kinematics have been employed to identify key variables contributing to the perception and reproduction of dynamics. Facilitating these changes in measurement techniques have been concurrent changes in statistical methods. The accuracy and variability with which learners can imitate a model has been quantified with techniques such as cross-correlation and normalized root mean squared error/difference. Data reduction methods such as regression and principal-component analysis have also been successfully employed to define key variables for future instruction. Despite these advances, important questions remain. First, do detailed kinematic analyses of movement form add substantially to more readily accessible, perceptually based assessments of form? Second, do the levels of analysis for human imitation actually reflect the perceptual capabilities of the system, or is there disparity between the levels of sensitivity of the perceptual system and the measurement tool? This presentation aims to address these questions, to provide a detailed outline of the methods used to elucidate critical information for learning and instruction, and to present appropriate practical uses for the information gained.

Perceptual Expertise in Sport: Novel Solutions to Old Problems

Williams, A.M. Liverpool John Moores University

Perceptual skill is an essential component of skilled performance, particularly in dynamic team sports. The ability to anticipate future events based on information arising early in an action sequence is one of the most important perceptual skills underlying effective motor performance. Although research on perceptual expertise in sport has expanded rapidly in recent years, knowledge as to the mechanisms underpinning anticipation skill remains limited. Researchers have tended to undertake descriptive work, merely outlining differences in performance between experts and novices, rather than attempting to determine the important mediating mechanisms. However, there are several methodological approaches to help outline the mechanisms underlying expert performance. These include spatial occlusion, verbal reports, point light displays, event related potentials, and eye movement recording. Other more novel approaches involve using statistical data reduction methods based on biomechanical features of the movement. Three-dimensional movement analysis

data from performers can be modeled using statistical techniques such as principal-component and regression analysis to examine the important components mediating performance and how these change as a function of skill level, as well as the relationship between these dimensions and successful outcomes. While each technique may be used in isolation, there are limitations, and consequently verification of findings using more than one approach is advised. The aim in this presentation is to provide a critical review of the available methodologies for assessing perceptual expertise, with implications for performance enhancement in sport and other domains.

Contemporary Methods for Exploring Emotional Influences on Attention and Performance

Janelle, C.M., S. Coombes, and A.R. Duley. University of Florida

Despite its theoretical and practical importance, current comprehension of how emotional reactivity is related to skilled motor performance is limited. With the study of psychopathology typically driving the mainstream literature on emotion, the manifestation of emotional reactions in performance indices of effectiveness and efficiency remains largely unspecified. Despite these limitations, novel approaches, both laboratory-based and otherwise, have been advanced in recent years. Innovative methodologies have begun to illuminate previously concealed mechanisms that underlie the emotion/attention interactions that largely dictate eventual performance. Results of recent laboratory studies that employed psychophysiological assessment of emotional states and their influence on simple motor task performance will be discussed. These results will be reviewed along with studies that have relied upon increasingly applied, ecologically valid environments and tasks, either simulated in the laboratory or monitored in actual competitive settings. Measures to be discussed include eye movements, pupil diameter, skin conductance, and cortical measures of activation and attention, among others. The relative practicality and utility of these different measures will be considered as related to current theoretical, empirical, and applied questions in sport psychology. Emphasized will be the need for continued complementary research in both basic and applied arenas that provides a path toward answering critical questions concerning the subtle mechanisms that underlie performance variability.

Using Advanced Statistical Methods for Revealing the Underlying Mechanisms of the Affect–Cognition–Motor Performance Linkage

Tenenbaum, G., R. Tate, and A. Kamata. Florida State University

On-line linkage between emotions, cognitions in the form of self-regulations and reflections, and performance has not been reported in the literature, despite its crucial role in revealing the underling mechanisms of performance fluctuations (e.g., positive and negative momentums, stability). Though traditional methods have attempted to illuminate the intensity of affective states associated with various performance levels using idiographic methodology, they suffered substantial practical and methodological limitations, excluding the possibility of linking them together on-line or in retrospect throughout the performance process. Advances in conceptualization and statistical techniques enable the development of methods that (a) can be used to illustrate this linkage for individual performers across and within the performance process, and (b) can contrast linkage patterns for performers varying in expertise level, experience, gender, or any variable of interest. The first method, probabilistic in nature, consists of transforming ordinal-logistic estimates, which stem from paired emotions-performance observations collected on-line or in retrospect, into probabilistic curves that constitute "affect-related performance zones." The paired observations can be than plotted within these zones on a time axis that represents the performance process. These plots illuminated alterations in emotions throughout performance and associ-

ated self-regulations. The second method illustrates how hierarchical linear modeling (HLM) is used to retain an idiographic focus, while adding a nomothetic perspective on the variations of individual emotions-performance relationship across athletes. Both methods include graphical representations that, when appropriately used, can advance the conceptual framework linking emotions, cognitions, and performance, and provide practitioners with valuable tools for working with performers of all kinds. The presentation illustrates the concepts, the statistical methods, and simulated and real-life examples of performers.

Motor Learning

"The Control of Interceptive Actions"

Montagne, G.[1], M. Lenoir[2], S. Bennett[3], and G.J.P. Savelsbergh[4]. [1]Marseille, France; [2]University of Gent; [3]UMIST, Manchester, UK; [4]Vrije University Amsterdam

Interceptive tasks are of particular interest in the area of motor control and learning, given the extent of the constraints affecting both perception and action. Naturally such tasks have deserved much attention in the last decade, and this symposium is designed to make an (inevitably partial) addition to the state of the art on the control of interceptive actions. Consequently, rather than concentrating on a specific topic we decided to give some insight into different kind of works focusing on different aspects of the perceptual-motor organization. We will first put the emphasis on the perceptual side. Gilles Montagne will show that the use of prospective perceptual variables can be sufficient to interact successfully with the environment, while Matthieu Lenoir will also show that the use of predictive perceptual variables can be decisive. We will then turn to the influence of type of visual presentation (intermittent vs. continuous) on the pick-up of information. More precisely, Simon Bennett will examine the influence of type of visual presentation on pursuit eye movements. We will end our survey with a presentation more related to the motor side. Geert Savelsbergh will examine the influence of postural constraints on the coordination of catching behavior.

Information-Movement Coupling in Interceptive Actions

Montagne, G., A. Chardenon, and R. Bootsma. Marseille, France

Intercepting a moving object while locomoting is certainly among the most complex abilities in the human repertoire, given the severe constraints that such a task places on both perception and action. The role of perceptual variables in the control process remains an open question. In this study a virtual reality setup was used for studying locomotor interception of a moving ball. Participants had to walk along a straight path and could freely modify forward velocity, if necessary, in order to intercept, with the head, a ball moving along a straight path that led it to cross the agent's displacement axis. In two experiments we manipulated the local (ball size) and the global (focus of expansion) components of the visual flow, but also the egocentric orientation of the ball. The results are in agreement with a model linking the displacement acceleration to properties of both the global flow and egocentric direction. The changes in locomotor velocity depend on a linear combination of the change in bearing angle and the change in egocentric direction, allowing the emergence of adaptive behavior under a variety of circumstances.

Catching a Ball During Locomotion: Do the Properties of the Ball Matter?

Lenoir, M. University of Gent

In order to catch a fly ball, a fielder needs information that guides him or her toward the future landing spot in an appropriate time window. Several models for interceptions during ego-motion have been developed, each of them building on the maintenance of a

certain spatiotemporal relationship between the catcher and the ball. Properties of the object, such as form or color, are not considered in these models. However, from a theoretical point of view a color pattern on the ball may be informative as to the future path of the ball, for example in the case of a spinning ball. Recent experimental data are presented that corroborate this prediction. It is shown that a future deviation from the initial trajectory of a spinning ball is perceived earlier when the ball has a contrasting color pattern on its surface, leading to significant changes in the player's behavior. In addition, the design and colors used on the surface of the ball may affect the quality of this information. This finding supports the thesis that, next to the information for maintenance of a certain spatiotemporal relationship between the player and the ball, properties of the ball itself often provide necessary additional information to guide a player toward a successful interception.

Now You See it, Now You Don't: Intermittent Vision in Interceptive Actions

Bennett, S., and G. Barnes. UMIST, Manchester, UK

Modifications to the environment often produce changes in task performance and have been used to determine what and how perceptual information is used. A common manipulation has been to present intermittent visual samples, giving control over what (e.g., binocular or monocular), and how long visual information is available. It is reasoned that if the interval between intermittent samples is less than their intrinsic persistence, they will overlap and be integrated into a continuous perceptual experience. In tasks requiring precise spatiotemporal control, it has been found that performance is modified when intermittent binocular samples are separated by approximately 80 ms. It has been suggested that the 80-ms ISI prevents integration of successive visual samples over time, leaving participants with static, positional visual information from each intermittent sample. This is supported by the finding that the negative effect of intermittent vision is offset by increasing the sample duration, presumably because it provides sufficient continuous visual information regarding the upcoming interception. At present, however, it is unclear what the effect of intermittent visual presentation is on pursuit eye movements which, although not necessary for discriminating the time of target interception, do normally track a moving target in order to hold its image on the retina, reducing blur and aiding perception. In this presentation, recent empirical data will be discussed concerning pursuit eye movements in manual aiming under conditions of intermittent visual presentation.

Postural Constraints on Interceptive Actions

Savelsbergh, G.J.P., S. Caljouw, K. Rosengren*, and J. Van der Kamp. Vrije University Amsterdam; *University of Illinois

An important characteristic of skilled catching performance is the ability to adapt the action to the continuously changing circumstances, e.g., circumstances that change as a result of changing constraints. Such a constraint could be informational or, for instance, postural. The aim of this experiment was to determine how catching performance is influenced when the demands on the postural system are varied, that is, a stable postural position is compared with a rather unstable postural position. For that purpose, adults performed one-handed catching under two postural conditions: standing upright with feet next to each other (stable postural position [SP]), and standing upright with feet after each other (unstable postural position [UP]). Three ball approach speeds were used (1 m/s, 1.5 m/s, and 2 m/s) in combination with the two postural conditions, leading to 6 experimental conditions. No differences in number of catches were found between the two conditions. When both postural conditions were compared, the findings revealed that in the UP condition the onset of the reach phase was earlier, $p < .01$; the time to reach maximal peak velocity of the arm

was earlier, $p = .05$; the maximal arm velocity was higher, $p < .05$; while the arm trajectory was longer, $p < .05$. In addition, the maximal hand opening was smaller, $p < .05$. In order to successfully catch in the UP condition, adjustments were made in the reach as well as the grasp component of the action.

Sport Psychology

"Stereotype Threat and Sport: Can Athletic Performance be Threatened?"

Beilock, S.L.[1], J. Stone[2], A.R. McConnell[1], S. Horton[3], and C.K. Harrison[4]. [1]Miami University; [2]University of Arizona; [3]Queen's University; [4]University of Michigan

Stereotype threat occurs when knowledge of a negative stereotype about a social group leads to less-than-optimal performance by members of that group. Although stereotype threat has been studied extensively in academic and cognitively-based tasks in the past several years, it has received little attention in sport despite its relevance to motor skills. Our symposium explores the stereotype threat phenomenon in sport and exercise. We begin with research demonstrating how merely introducing a negative stereotype about a social group can induce performance decrements in members of that group. For example, framing a golf-putting task as a test of "natural athletic ability" harms the golf performance of White golfers, while framing the same golf task as a test of "athletic intelligence" harms the performance of Black golfers. But how do these performance decrements occur? We next discuss the cognitive mechanisms underlying stereotype threat in sport and provide evidence that sport skills (e.g., golf-putting) may fail under stereotype threat in very different ways than the more cognitively-based academic tasks traditionally examined in the literature on stereotype threat (e.g., SAT or GRE performance). Next we discuss some long-term consequences of stereotype threat. In particular we address how negative stereotypes about seniors and physical activity may lead older adults to disengage from being active to avoid confirming the negative cultural stereotype that physical activity is problematic for older adults. Finally, our discussant, a former college athlete and a stereotypes researcher, will describe his own stereotype threat experiences and his ongoing work examining how stereotypes of minority groups shape their participation in athletic and academic domains. Stereotype threat has important consequences for athletics, for example by impairing athletic performance and/or maintaining underrepresentation of minority athletes and older adults in sports and physical activity. Thus it deserves further attention in sport and exercise psychology.

Stereotype Threat in Sports: How Negative Cultural Stereotypes Impair Athletic Performance

Stone, J. University of Arizona

I will present the results of several studies showing that the threat of confirming a negative stereotype about an important social identity has a negative impact on the preparation and performance of various groups in sports. We have documented, for example, that when made salient in a sports performance context, negative racial stereotypes about Black (e.g., sports intelligence) and White participants (e.g., natural ability) impairs their performance on a golf-putting task. Other studies have shown that when natural ability is made salient in a sports performance context, White participants are motivated to adopt behavioral self-handicapping as a strategy for deflecting the threat to their identity. A recent set of studies examined the hypothesis that because low natural athletic ability is also a negative stereotype about female athletes, the attribute of "natural athletic ability" may cause qualitatively different types of stereotype threat concerns for White male and female athletes.

Specifically, linking natural ability to performance causes a threat to the gender identity of White female athletes, but a threat to the racial identity of White male athletes. The results of two experiments showed that, as predicted, White females performed significantly worse on a basketball shooting task when natural ability was linked to gender differences in sports, whereas White males performed worse when natural ability was linked to racial differences in sports, compared to control conditions. I will discuss the potential mechanisms underlying these effects and the implications for understanding the pernicious role of negative stereotypes in athletic performance.

How do Stereotypes Threaten Athletes? Exploring Causal Mechanisms of Stereotype Threat

McConnell, A.R.[1], S.L. Beilock[1], W.A. Jellison[2], R.J. Rydell[1], and T.H. Carr[2]. [1]Miami University; [2]Michigan State University

Stereotype threat is revealed when knowledge of a negative stereotype about one's social group impairs performance in the stigmatized domain. Although stereotype threat impairs performance across a wide range of social groups and task types (Wheeler & Petty, 2001), few studies have examined the underlying cognitive processes responsible for these performance decrements. Moreover, little research has explored its consequences for sport despite the widespread prevalence of athletic stereotypes suggesting that members of certain social groups may not excel in cognitively-demanding roles (e.g., Black athletes should not be quarterbacks) or in sensorimotor-demanding roles (e.g., White athletes should not be running backs). In the laboratory, we examined how stereotype threat is manifested differently in cognitive skills (using mathematical problem-solving in Studies 1 and 2) and sensorimotor skills (using golf-putting in Studies 3 and 4). Similar to recent findings (Schmader & Johns, 2003), stereotype threat exerted its impact on the cognitive skill of mathematical problem-solving by consuming or reducing the working memory capacity needed to solve these problems. However, a very different mechanism was observed in golf-putting. Consistent with recent work on the choking-under-pressure phenomenon (Beilock & Carr, 2001), stereotype threat in the sensorimotor skill of golf-putting appeared to result from too much attention to execution, rather than too little. That is, stereotype threat harms well-learned sensorimotor skills by prompting explicit attention to proceduralized processes that normally run outside of conscious awareness. Thus, stereotype threat exerts multiple impacts on the cognitive system, inducing performance decrements for different reasons in different tasks.

Effects of Cultural Stereotypes of Aging on Physical and Cognitive Performance of Seniors

Horton, S., J. Baker, J. Deakin, J. Côté, and B. Levy. Queen's University

Studies have shown that attitudes toward aging in North America held by young and old alike are predominantly negative (Levy & Langer, 1994). Such widespread agreement about a group can lead to the development of stereotypes, which can have a significant influence on behavior among members of the stereotyped group (Wheeler & Petty, 2001). For instance, researchers examining the influence of one's attitude toward aging have revealed that priming seniors with positive stereotypes of aging can lead to better performance on cognitive tasks such as memory (Levy & Langer, 1994) and physical tasks such as walking (Hausdorff, Levy, & Wei, 1999). Although the most obvious effects of stereotypes in studies to date have been immediate (e.g., short-term performance effects), researchers (e.g., Major, Spencer, Schmader, Wolfe, & Crocker, 1998) have speculated that the most damaging effects might be long-term, such as feelings of dissatisfaction and ultimately disengagement. Seniors who believe that physical and cognitive decline are inevitable aspects of growing older may disengage from activities that challenge these abilities

in order to preserve their self-image. This can have important ramifications, as the lack of physical and cognitive activity is believed to be the principal cause of functional decline in elderly populations (Maharam, Bauman, Kalman, Skolnik, & Perle, 1999). Recently our research team began a study exploring the short- and long-term effects of stereotypes on aging in active and nonactive seniors. This presentation will propose a theoretical model of how cultural stereotypes of aging lead to physical inactivity in old age, and will summarize the progress made to date.

Threatening the Stereotype: Activating the Academic Perception in the Athletic Incubator

Harrison, C.K. University of Michigan

I will respond to four papers/presentations centered on stereotype threat theory and the effects of this phenomenon in academic and athletic cultures. After synthesizing these papers and extending the various studies in the session to the broader social context of society, I have three goals: First, to present qualitative data based on a photo-elicitation design that is the counter-narrative to the "dumb jock" stereotype so prevalent in American higher education. Second, I plan to also present how Arizona State University and Louisiana State University have implemented the concept of the "scholar-baller" (Harrison, 1998, 2002) specifically with male revenue sport participants (Division I football and basketball). The basis of this approach is to eliminate this dichotomy for student-athletes by helping them reconceptualize the mental and physical aspects of their self-concept (Stone & Harrison, in preparation). The goal of the "scholar-baller" intervention is to help student-athletes integrate their academic and athletic self-concepts into *one* positive superordinate self-image (Steele, 1998). The hypothesis is that when a threat to their academic self-concept is imposed by the salience of a negative stereotype in the classroom, the integrated "scholar-athlete" conception of self can then serve as an affirmational resource that reduces their concern and empowers them to perform well in the testing context (Steele et al., 2002) and compete with passion and character academically as they do athletically (Boyd, 2002). Third, I will briefly express anecdotes of my experiences as a former student-athlete in football and my observations of contemporary stigmas of student-athletes as a faculty member the last decade at two Division I institutions and one community college.

PRE-CONFERENCE SYMPOSIUM

"Teaching Exercise Psychology"

Ekkekakis, P.[1], W.R. Bixby[2], S.N. Culos-Reed[3], E.E. Hall[4], and K.A. Martin Ginis[5]. [1]Iowa State University; [2]Texas Tech University; [3]University of Calgary; [4]Elon University; [5]McMaster University

Fifty known books published in the English language between 1981 and 2004 include variants of the words "exercise" and "psychology" in their title. Of these, nearly half (21) have been published since 2000. This number includes no less than 5 college textbooks, published in a 3-year period, between 2001 and 2003. These figures illustrate the dramatic growth of exercise psychology in recent years, not only as a research field but also as a component of exercise science and kinesiology curricula. An increasing number of programs recognize the need to educate students about exercise psychology, as the health and fitness markets expect professionals capable of promoting physical activity, optimizing the experiences that participants derive, enhancing adherence, and reducing the risk of dropout. Therefore, as exercise psychology reaches more and more classrooms, it is desirable to

exchange ideas on how to enhance student learning. This symposium will include presentations on (a) conveying the value and practicality of psychological theories (Martin); (b) teaching topics (i.e., exercise in special populations, exercise and cognitive performance in the elderly, and exercise, stress, and disease) that, although important, are not yet included in the published exercise psychology textbooks (Culos-Reed, Bixby, Ekkekakis); and (c) incorporating relevant and engaging learning activities that facilitate student learning (Hall).

There is Nothing so Practical as Teaching a Good Theory

Martin-Ginis, K.A. McMaster University

Kurt Lewin's famous statement that "there is nothing so practical as a good theory" (1951, p. 169) is considered a truism among exercise psychologists. Yet unfortunately, most undergraduates are not so easily convinced. The objectives of this session are to (a) present teaching strategies that can help convey the value of theory to undergraduate exercise psychology classes, and (b) share examples of in-class activities and demonstrations that can help students make the connection between theory and real-world application in exercise psychology. Strategies will reflect a variety of instructors' experiences. Specific examples will reflect commonly taught theories (e.g., Theory of Planned Behavior, Self-Efficacy Theory).

A Special Population: The Role of Exercise for Cancer Survivors

Culos-Reed, S.N. University of Calgary

As Exercise Psychology enters a crucial developmental phase, the teaching methods and tools utilized will play a crucial role in disseminating knowledge within exercise psychology. In particular, the development of textbooks is of critical importance. To date, exercise psychology texts are limited in their offerings on the role of exercise for various health-risk populations. Given the increased prevalence of chronic disease, and the emerging literature on the role of exercise in the prevention and treatment of chronic disease, exercise psychology texts should consider addressing the role of exercise for various special populations. One such example is the growing research on the role of exercise for cancer survivors (Courneya & Friedenreich, 1999; Pinto, Eakin, & Maruyama, 2000). The literature clearly supports the role of exercise for promoting both physical and psychological well-being in cancer survivors. Specifically, physical activity is an intervention that improves both physiological (e.g., functional capacity, body composition, fatigue, and nausea) and psychological (locus of control, mood states, self-esteem, and well-being) outcomes in the adult oncology population. The potential role in improving immune function and decreasing future cancer risk is currently being investigated. This presentation will provide an update on the developments in this research area and will also demonstrate the teaching tools (slides, graphs, pictures) that can be used in the classroom setting.

The Importance of Teaching Exercise and Cognition in the Elderly

Bixby, W.R. Texas Tech University

Although the number of textbooks that focus on exercise psychology is on the rise, some topics receive less coverage than they deserve. One such topic is the relationship between exercise and cognition, particularly in the elderly. The majority of textbooks in the exercise psychology field give no mention of the topic, and the only text that does cover the issue (Carron, Hausenblass, & Estabrooks, 2003) does so in 2.5 pages. However, given the importance of this topic for public health and well-being, as well as the considerable developments in this area of research in the last few years, instructors may wish to educate their students about it. Therefore, the purpose of this discussion is to (a) highlight the importance of the exercise and cognition relationship in the elderly; (b) discuss the key historical research findings and where they have led us; (c) overview current research including Kramer

and colleagues' Executive Control Hypothesis, and Cottman and colleagues' findings related to Brain Derived Neurotrophic Factor (BDNF); and (d) demonstrate teaching tools that have helped to illustrate the key issues.

Teaching the Relationships Between Exercise, Stress, and Disease

Ekkekakis, P. Iowa State University

Although relieving stress is one of the most often-cited reasons for participating in physical activity, and the research literature on the relationships between exercise, stress, and psychosocially mediated disease is large and continuously expanding, this topic is not adequately covered in published exercise psychology textbooks. However, it is a topic that can easily intrigue students and ignite their interest. The presentation will (a) cover a basic set of stress-related concepts that are appropriate for undergraduate teaching (i.e., the fundamental neuroanatomy and neurophysiology of the stress response, the Selye-Mason debate on the specificity of the stress, Frankenhaeuser's model of epinephrine-cortisol patterning, Chrousos' concept of the "chronicity" of stress as its pathogenic component, the Type A Behavior Pattern, "vital exhaustion," the hostility-CVD link, the Type C Behavior pattern, and the psycho-endocrine-immunological model), and (b) demonstrate materials (i.e., graphs of theoretical models and research findings) that, due to their high interest and clarity, have been found to facilitate learning.

Learning Activities for Exercise Psychology

Hall, E.E. Elon University

Most instructors of exercise psychology courses supplement their teaching with additional learning opportunities for students (homework exercises, laboratory activities, various psychological assessments, simulated motivational interviews, etc.). Such activities can significantly enhance the learning process by (a) making abstract, theoretical concepts more concrete and therefore easier to understand; (b) providing hands-on experiences and thus highlighting the practicality of conceptual knowledge; and (c) enabling discovery and promoting independent, critical thinking. The presentation will offer an anthology of learning activities that have been used in conjunction with most of the topics covered in exercise psychology textbooks. Specifically, activities will be presented to familiarize students with (a) basic concepts in research methods and study design; (b) assessment of key variables in exercise psychology (benefits and barriers, attitude, personality); (c) basic theories of exercise behavior and adherence; (d) evaluation of psychological responses to exercise (enjoyment, affect, perceived exertion); and (e) intervention methods (exertion management, goal-setting, self-monitoring, behavioral contracting).